Inventor: MACKLIN ET AL
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Examiner: MERCADO
Group Art Unit: 1745

REMARKS

The Office action of June 25, 2004 has been carefully considered, and reconsideration is respectfully requested.

Claim 1 has been amended solely for the purpose of using the Americanized spelling for the word "aluminum."

The examiner has taken a position that claims 1 to 6 are not enabled. Applicants respectfully submit that the examiner has misinterpreted the wording of claim 1. The term "alloy" has been defined in the description on page 2, lines 23 to 27 as encompassing both conventional alloys and lithium/elemental compounds. Thus, the claim covers the situation where lithium insertion occurs by conventional alloy formation, or by the formation of a lithium/elemental compound. Further, page 1 of the description makes it clear that tin and aluminum anodes undergo lithium insertion by (conventional) alloy formation. The claim is therefore enabled.

Likewise, claims 2 to 6 are enabled as they depend on claim 1.

The examiner is also objecting that the claims lack inventive step over Che *et al.* (Nature 393, 346-349) in view of Green *et al.* (US 6,090,363). However, applicants respectfully submit that the examiner has not interpreted the disclosure of these documents correctly.

Che et al discloses a process for forming carbon nanostructure. The process uses chemical vapor deposition (CVD) to form carbon tubules inside the pores of a commercially available alumina template membrane. Catalytic metal

nanoparticles are then introduced into the tubules by immersion of the carbon-alumina membrane in an appropriate solution. One of the metals that may be introduced is iron using an ethanolic solution. The alumina is then dissolved away using HF to leave a carbon-tubule membrane. Che *et al.* then goes on to state that iron nanoparticles in tubules can be used as catalysts for the CVD growth of carbon nanotubes. This method can then be used to grow carbon nanotubes inside the tubules. This results in a structure of carbon tubules which contain carbon nanotubes.

Che et al then goes on to discuss using these carbon structures in anodes. Che *et al.* expressly states that their experiments were aimed at finding out whether the carbon tubule membrane can intercalate Li+ and whether this is improved where there are nanotubules (Fe catalyzed) inside the tubules. The article indicates that Li+ intercalation does occur and is improved by the presence of nanotubes inside the tubules. However, Che *et al.* only ever discloses the presence of Fe in catalytic amounts. Further Che *et al.* also only considers and discloses the intercalation of Li+ in the carbon tubules and carbon nanotubules. There is no disclosure, teaching or suggestion that the Li+ intercalates into Fe (which is not surprising as Fe is not present except in catalytic amounts!).

Thus, applicants submit that the examiner has misinterpreted the disclosure of Che *et al.*

Green *et al.* discloses a method of forming open ended carbon nanotubes and depositing a material inside the open tubes. Column 2, lines 6 to 32 disclose a variety of materials which may be deposited in the carbon nanotubes. Lines 10 to 13 disclose a

large number of elements including aluminum which may be useful as heterogeneous catalysts. Lines 19 to 21 list another group of elements which may be used as heterogenous catalyst and these include iron. The fact that these groups of potential catalysts are listed entirely separately makes it unlikely that anyone skilled in the art would simply choose to substitute one of these elements for another. Further, there is no teaching or suggestion that these catalysts could have any similar properties whatsoever and therefore there is no teaching or suggestion to lead one skilled in the art to substitute any of these elements for each other. Therefore, in particular, one skilled in the art would not choose to substitute iron with aluminum!

The examiner is also contending wrongly that Green et al. teaches that aluminum is a ferromagnetic material which can be substituted for iron! Materials with ferromagnetic properties are mentioned in column 2, line 18, and materials with ferromagnetic properties are mentioned on line 13. However, these materials are mentioned entirely separately from either set of heterogeneous catalysts described above. This is entirely clear as each type of material mentioned in column 2 is separated from the next using semi-colons. Thus, it is entirely clear that heterogeneous catalysts, ferromagnetic and ferromagnetic materials are each mentioned separately as alternative materials for deposition in the carbon nanotubes.

The examiner has also mentioned Ajayan (US 5,457,343) at the end of the office action though he does not appear to have relied on this document as the basis for an objection. Ajayan is a general disclosure of coaxial carbon nanotube which may contain any one of many foreign materials (listed in column 3, lines 21 to 35) in the nanometer carbon tubule. The present invention is

novel due to the selection of specific materials for inclusion in the tubule. The present invention also possesses an inventive step as the specific materials inserted in the present invention all have the property of intercalating with lithium which gives the carbon tubules the unexpected effect of being suitable for use in the anode of a cell.

In view of the foregoing, applicants respectfully submit that claims 1-6 are enabling and also patentably distinguish over the prior art. Accordingly, reconsideration of the application is requested and allowance thereof is courteously solicited.

The Commissioner is hereby authorized to charge any required fees associated with this communication and during the pendency of the application under 37 CFR 1.16 and 37 CFR 1.17 or to credit any overpayment to Deposit Account No. 082670.

Respectfully submitted,

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Date

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I hereby certify that this correspondence is being transmitted by facsimile this day to Julian Mercado at the United States Patent and Trademark Office, Art Unit 1745, to fax No. 703-872-9306.

October 25, 2004 Kathleen Holt
Date Signature